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TP65H030G4PWS

650V SuperGaN® GaN FET in TO-247-3 (source tab)

Description

The TP65H030G4PWS 650V, 30mΩ Gallium Nitride (GaN) FET is a normally-off device using Renesas' Gen IV plus platform. It combines a state-of-the-art high voltage GaN HEMT with a low voltage silicon MOSFET to offer superior performance, standard drive, ease of adoption and reliability.

The Gen IV plus SuperGaN® platform uses advanced epi and patented design technologies to simplify manufacturability while improving efficiency over silicon via lower gate charge, output capacitance, crossover loss, and reverse recovery charge.

Benefits

- Superior normally off architecture with D-mode GaN HEMT
- Compatible with standard silicon drivers
- Enhanced noise immunity with a 4V threshold voltage with no negative gate drive required
- Enables high-efficiency, high power density, and reliable power conversion
- Facilitates cost-effective GaN adoption reducing system size, weight, and costs

Features

- Ultra-fast switching Gen IV plus GaN
- JEDEC-qualified GaN technology
- Dynamic  $R_{DS(on)eff}$  production tested
- Reduced crossover loss
- Negligible  $Q_{rr}$
- RoHS compliant and Halogen-free packaging

Applications

- AI datacenter and telecom power supplies
- E-mobility charging
- PV inverter
- UPS
- BESS

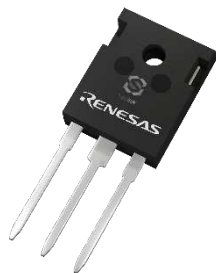


Specifications

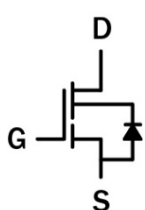
$V_{DS}$ (V)	650
$V_{DSS(TR)}$ (V) maximum	800
$R_{DS(on)}$ (mΩ) maximum [1]	41
$Q_{OSS}$ (nC) typical	135
$Q_G$ (nC) typical	24.5

1. Dynamic  $R_{DS(on)}$  (see Figure 17 and Figure 18)

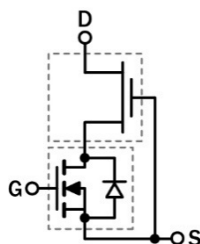
Product/Schematic Diagrams



TP65H030G4PWS TO-247-3



Cascode Schematic Symbol



Cascode Device Structure

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## 1. Pin Information

### 1.1 Pin Assignments



Figure 1. Pin Assignments – Bottom View

### 1.2 Pin Descriptions

Pin Number	Pin Name	Description
1	G	Gate.
2	S	Source.
3	D	Drain.

## 2. Specifications

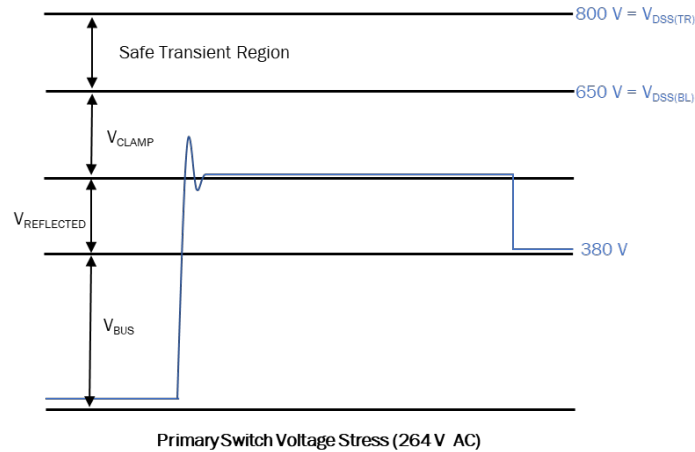
### 2.1 Absolute Maximum Ratings

$T_c = 25^\circ\text{C}$  unless otherwise stated.

**Caution:** Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

Symbol	Parameter	Minimum	Maximum	Unit
$V_{DSS}$	Drain to source voltage ( $T_J = -55^\circ\text{C}$ to $150^\circ\text{C}$ )	-	650	V
$V_{DSS(TR), \text{non-repetitive}}$	Transient drain to source voltage, non-repetitive <sup>[1]</sup>	-	800	
$V_{DSS(TR), \text{repetitive}}$	Transient drain to source voltage, repetitive <sup>[2]</sup>	-	750	
$V_{GSS}$	Gate to source voltage	-20	+20	
$P_D$	Maximum power dissipation at $T_c = 25^\circ\text{C}$	-	192	W
$I_D$	Continuous drain current at $T_c = 25^\circ\text{C}$	-	55.7	A
	Continuous drain current at $T_c = 100^\circ\text{C}$	-	35	A
$I_{DM}$	Pulsed drain current (pulse width: 10 $\mu\text{s}$ )	-	230	A
$T_J$	Operating temperature junction	-55	+150	$^\circ\text{C}$
$T_S$	Storage temperature	-55	+150	$^\circ\text{C}$
$T_{SOLD}$	Soldering peak temperature <sup>[3]</sup>	-	260	$^\circ\text{C}$

1. In off-state, spike duration < 30 $\mu\text{s}$ , non-repetitive.
2. Off-state, spike duration < 5 $\mu\text{s}$ .
3. For 10 sec., 1.6mm from the case.



### 2.2 Thermal Specifications

Symbol	Condition	Typical Value	Unit
$R_{\theta JC}$	Junction-to-case	0.65	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-ambient	40	

## 2.3 Electrical Specifications – Forward Device

T<sub>J</sub> = 25°C unless otherwise stated.

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Unit
V <sub>DSS(BL)</sub>	Maximum drain-source voltage	V <sub>GS</sub> = 0V	650	-	-	V
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1mA	3.3	4	4.8	V
ΔV <sub>GS(th)</sub> /T <sub>J</sub>	Gate threshold voltage temperature coefficient		-	-6.5	-	mV/°C
R <sub>DS(on)eff</sub>	Drain-source on-resistance <sup>[1]</sup>	V <sub>GS</sub> = 12V, I <sub>D</sub> = 30A, T <sub>J</sub> = 25°C	-	30	41	mΩ
		V <sub>GS</sub> = 12V, I <sub>D</sub> = 30A, T <sub>J</sub> = 150°C	-	62	-	
I <sub>DSS</sub>	Drain-to-source leakage current	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C	-	3	30	μA
		V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C	-	20	-	
I <sub>GSS</sub>	Gate-to-source forward leakage current	V <sub>GS</sub> = 20V	-	-	400	nA
	Gate-to-source reverse leakage current	V <sub>GS</sub> = -20V	-	-	-400	
C <sub>ISS</sub>	Input capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 400V, f = 1MHz	-	1500	-	pF
C <sub>OSS</sub>	Output capacitance		-	127	-	
C <sub>RSS</sub>	Reverse transfer capacitance		-	4.6	-	
C <sub>O(er)</sub>	Output capacitance, energy related <sup>[2]</sup>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 400V	-	183	-	pF
C <sub>O(tr)</sub>	Output capacitance, time related <sup>[3]</sup>		-	339	-	
Q <sub>G</sub>	Total gate charge	V <sub>DS</sub> = 400V, V <sub>GS</sub> = 0V to 12V, I <sub>D</sub> = 30A	-	24.5	-	nC
Q <sub>GS</sub>	Gate-source charge		-	8.4	-	
Q <sub>GD</sub>	Gate-drain charge		-	6.6	-	
Q <sub>OSS</sub>	Output charge	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 400V	-	135	-	nC
t <sub>D(on)</sub>	Turn-on delay	V <sub>DS</sub> = 400V, V <sub>GS</sub> = 0V to 12V, R <sub>G(on)</sub> = 10Ω, R <sub>G(off)</sub> = 30Ω, I <sub>D</sub> = 30A, Z <sub>FB</sub> = 180Ω at 100MHz (see Figure 15)	-	40.8	-	ns
t <sub>R</sub>	Rise time		-	6.8	-	
t <sub>D(off)</sub>	Turn-off delay		-	89.2	-	
t <sub>F</sub>	Fall time		-	8	-	

1. Dynamic R<sub>DS(on)</sub>, 100% tested; see Figure 17 and Figure 18 for conditions.
2. Equivalent capacitance to give same stored energy from 0V to 400V.
3. Equivalent capacitance to give same charging time from 0V to 400V.

## 2.4 Electrical Specifications – Reverse Device

$T_J = 25^\circ\text{C}$  unless otherwise stated.

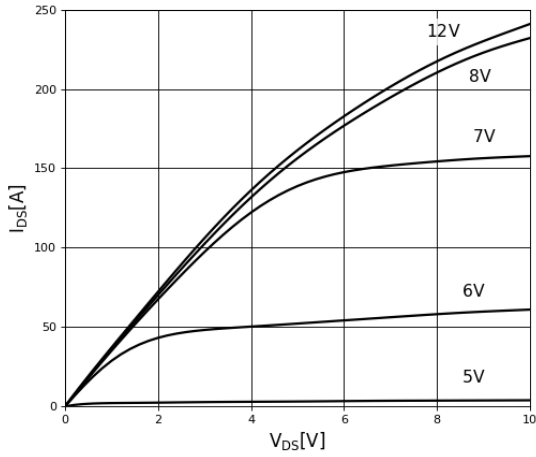
Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Unit
$I_S$	Reverse current	$V_{GS} = 0V$ , $T_C = 100^\circ\text{C}$ , $\leq 25\%$ duty cycle	-	-	32	A
$V_{SD}$	Reverse voltage <sup>[1]</sup>	$V_{GS} = 0V$ , $I_S = 32A$	-	1.8	-	V
		$V_{GS} = 0V$ , $I_S = 16A$	-	1.3	-	

1. Includes dynamic  $R_{DS(on)}$  effect.

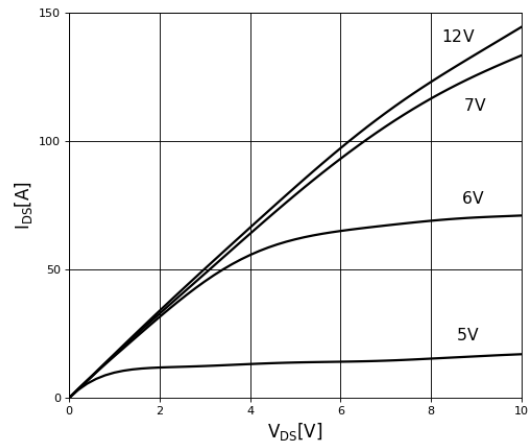
Note: Reverse recovery charge is negligible, enabled by the LV Si FET technology

### 3. Typical Performance Graphs

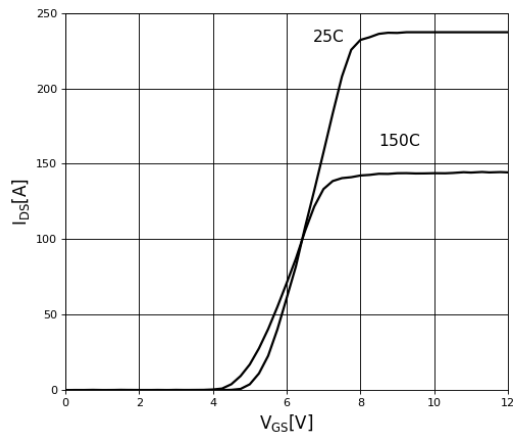
$T_c = 25^\circ\text{C}$  unless otherwise stated.



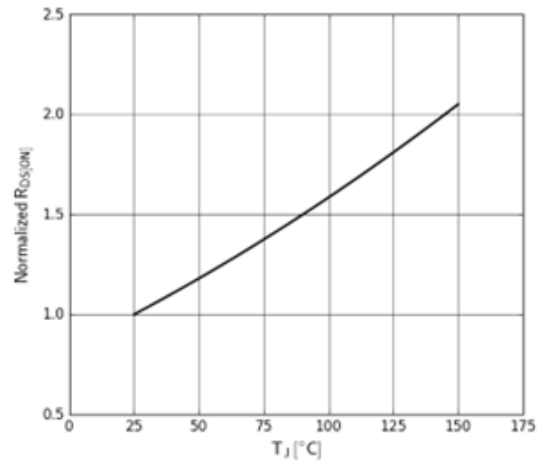
**Figure 2. Typical Output Characteristics,  $T_J = 25^\circ\text{C}$**   
Parameter:  $V_{GS}$



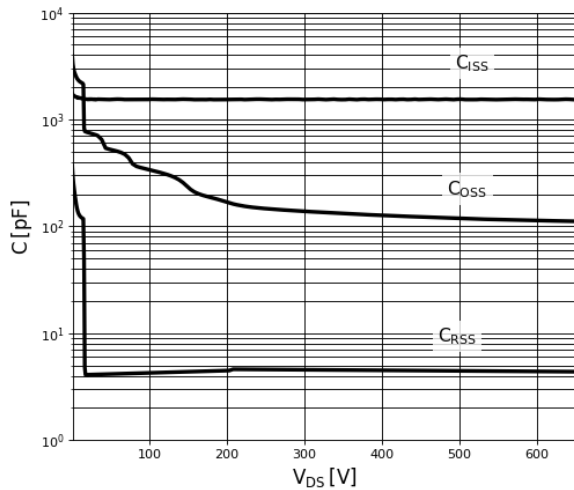
**Figure 3. Typical Output Characteristics,  $T_J = 150^\circ\text{C}$**   
Parameter:  $V_{GS}$



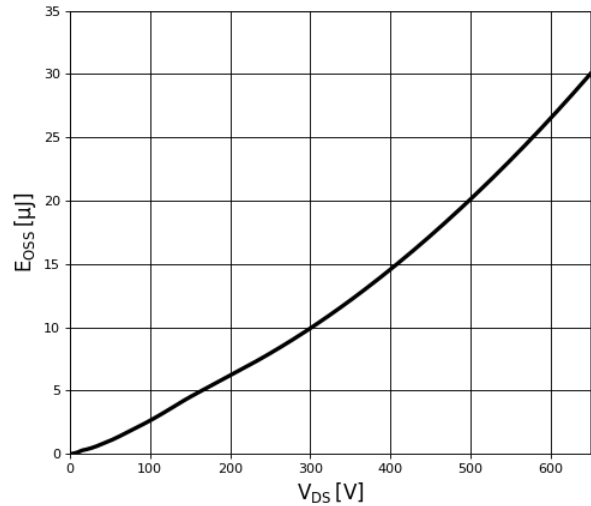
**Figure 4. Typical Transfer Characteristics**  
 $V_{DS} = 10\text{V}$ , Parameter:  $T_J$



**Figure 5. Normalized On-resistance**  
 $I_D = 30\text{A}$ ,  $V_{GS} = 12\text{V}$



**Figure 6. Typical Capacitance**  
 $V_{GS} = 0\text{V}$ ,  $f = 1\text{MHz}$



**Figure 7. Typical  $C_{OSS}$  Stored Energy**

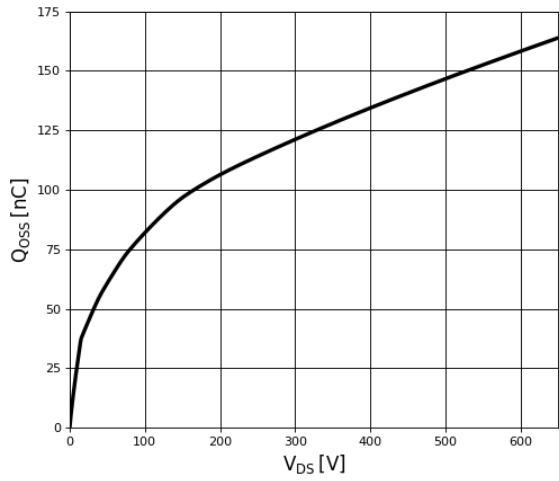


Figure 8. Typical Qoss

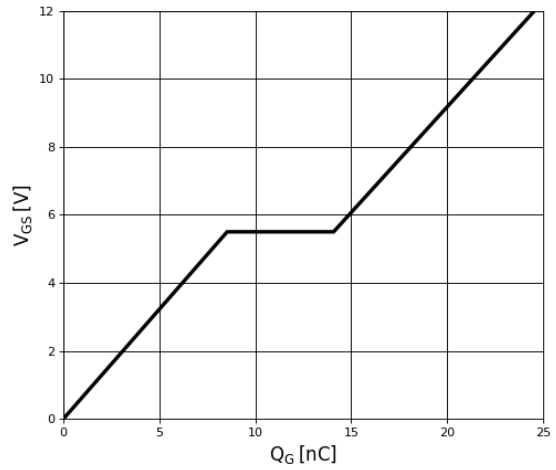


Figure 9. Typical Gate Charge

$I_{DS} = 30A, V_{DS} = 400V$

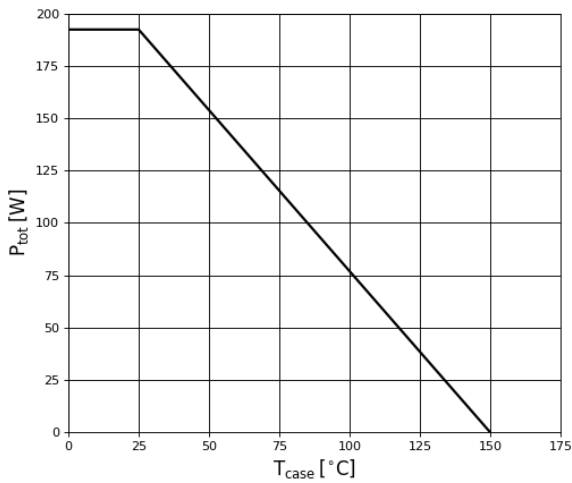


Figure 10. Power Dissipation

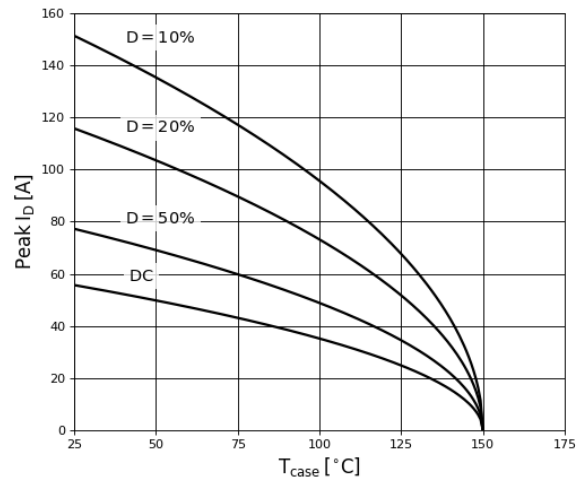


Figure 11. Current Derating

Pulse width  $\leq 10\mu s, V_{GS} \geq 12V$

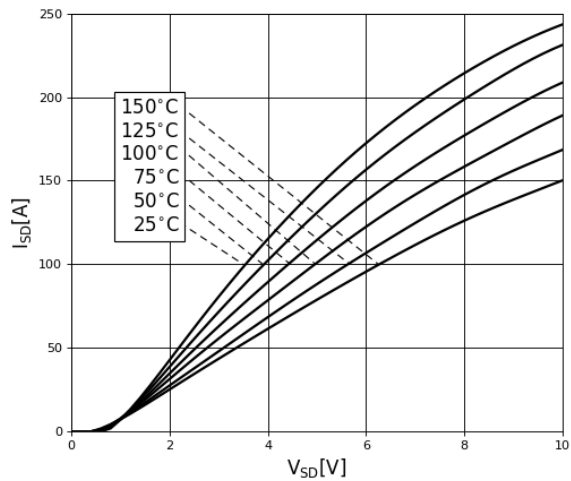


Figure 12. Forward Characteristics of Rev. Diode

$I_S = f(V_{SD}), \text{Parameter: } T_J$

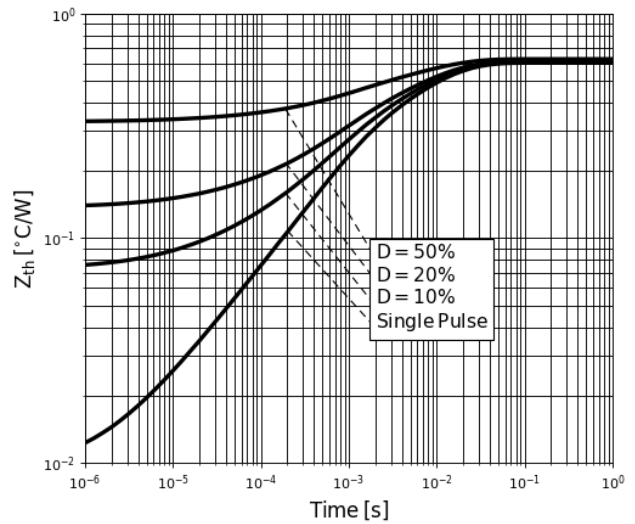


Figure 13. Transient Thermal Resistance

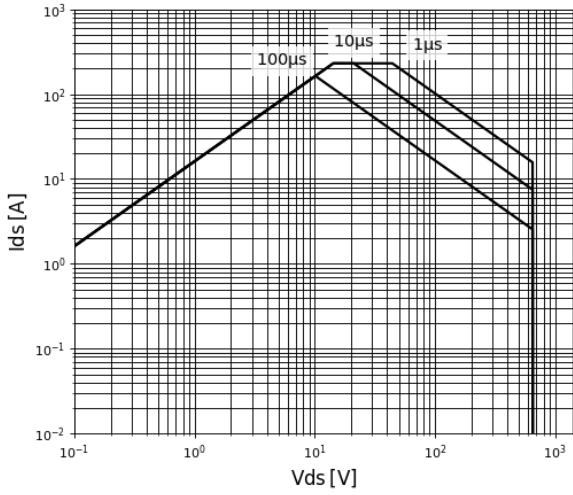


Figure 14. Safe Operating Area  $T_c = 25^\circ\text{C}$

## 4. Test Circuits and Waveforms

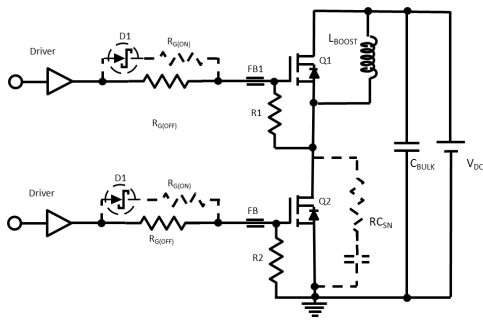


Figure 15. Switching Time Test Circuit

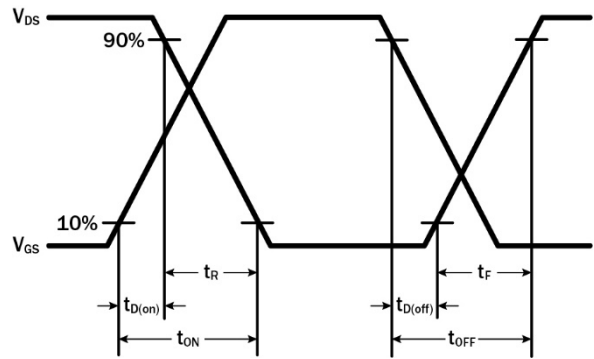


Figure 16. Switching Time Waveform

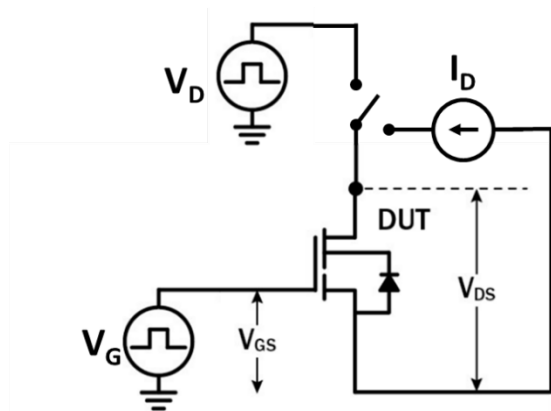


Figure 17. Dynamic  $R_{DS(on)eff}$  Test Circuit

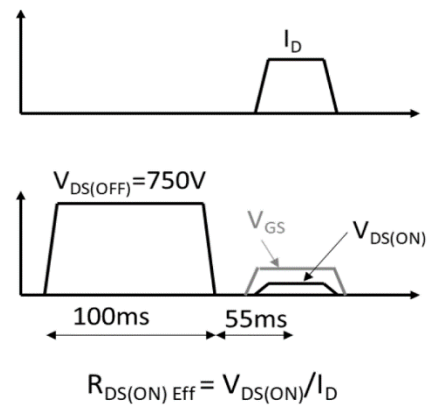


Figure 18. Dynamic  $R_{DS(on)eff}$  Waveform

### 5. Package Outline Drawings

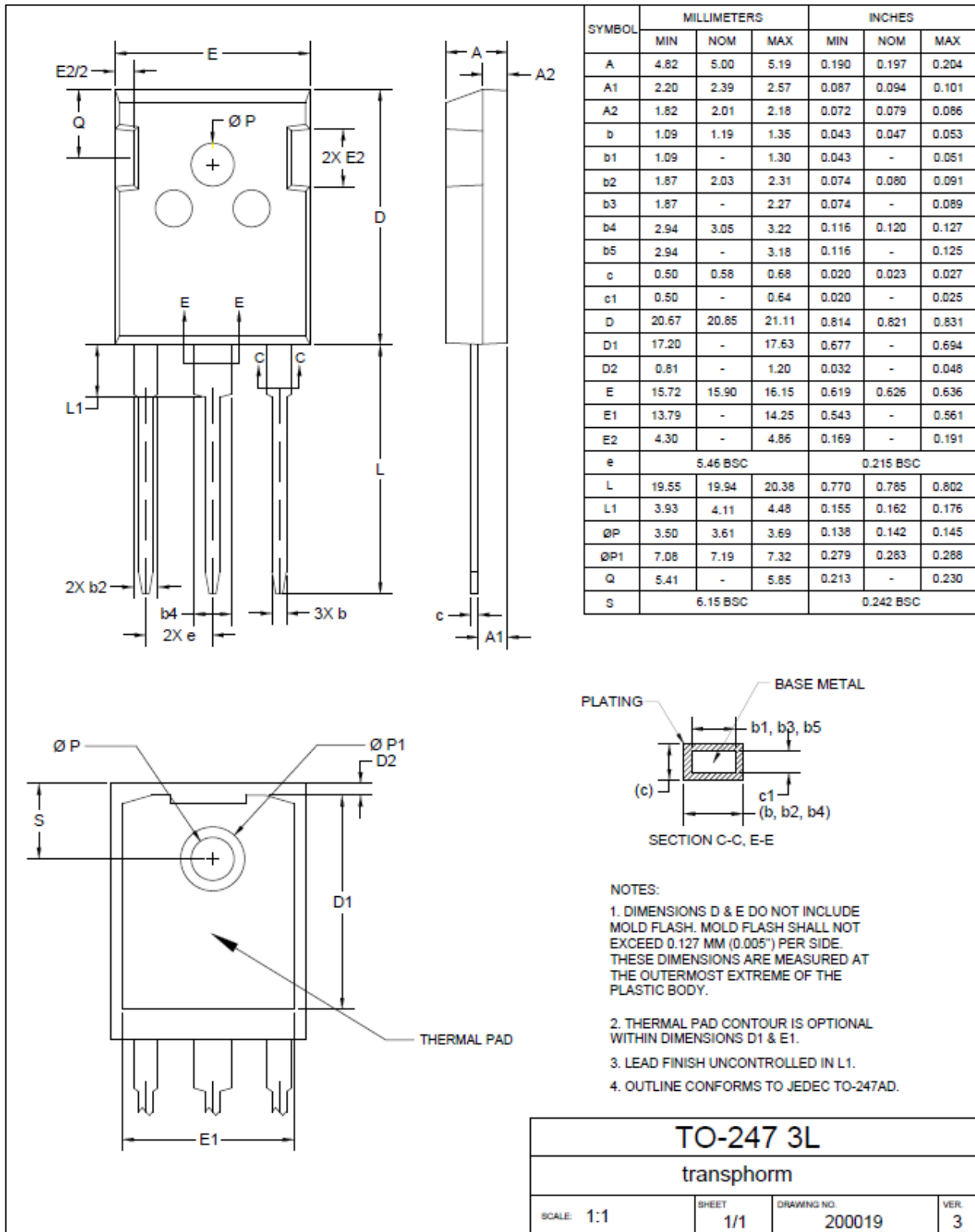


Figure 19. TO-247 3L Package Outline Drawing

## 6. Related Information

All technical documents for Renesas GaN Power devices are accessible from the [GaN Power Solutions](#) page.

## 7. Ordering Information

Part Number	Package Description	Package Configuration
TP65H030G4PWS	TO-247 3L	Source

## 8. Revision History

Revision	Date	Description
2.00	Nov 25, 2025	Updated the document's formatting; no technical changes were completed.
1.00	May 13, 2025	Initial release.

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